Electron Configuration Practice Worksheet

In the space below, write the unabbreviated electron configurations of the following elements:

1) sodium $1s^2 2s^2 2p^6 3s^1$
2) iron $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$
3) bromine $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$
4) barium $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6 6s^2$
* 5) neptunium $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6 6s^2 4f^{14} 5d^{10} 6p^6 7s^2$ $6d^1 5f^4$

In the space below, write the abbreviated electron configurations of the following elements:

1) cobalt $[Ar]\ 4s^2 3d^7$
2) silver $[Kr]\ 5s^2 4d^9$
3) tellurium $[Kr]\ 5s^2 4d^{10} 5p^4$
4) radium $[Rn]\ 7s^2$
5) lawrencium $[Rn]\ 7s^2 6d^1 5f^{14}$

Determine what elements are denoted by the following electron configurations:

1) $1s^2 2s^2 2p^6 3s^2 3p^4$ Sulfur S
2) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^1$ Rubidium Rb
3) $[Kr]\ 5s^2 4d^{10} 5p^3$ Antimony Sb
4) $[Xe]\ 6s^2 4f^{14} 5d^6$ Osmium Os
5) $[Rn]\ 7s^2 5f^{11}$ Einsteinium Es

Determine which of the following electron configurations are not valid, then write the corrected electron configuration using the <u>SAME</u> number of electrons:

1) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4d^{10} 4p^5$ $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$
2) $1s^2 2s^2 2p^6 3s^2 3d^5$ $1s^2 2s^2 2p^6 3s^2 3p^6$
3) $[Kr]\ 4s^2 3d^7$ $[Ar]\ 4s^2 3d^7$
4) $[Kr]\ 5s^2 4d^{12} 5p^2$ $[Kr]\ 5s^2 4d^{10} 5p^4$
5) [Xe] $[Kr]\ 5s^2 4d^{10} 5p^6$

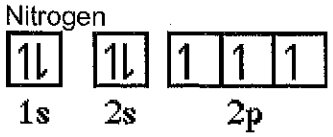
* don't worry about configurations for elements past 56 .... yet ☺

Electron Configurations and Orbital Diagrams

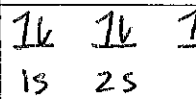
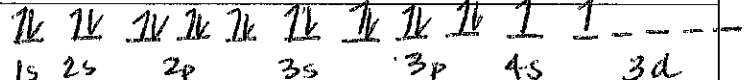
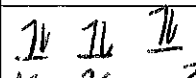
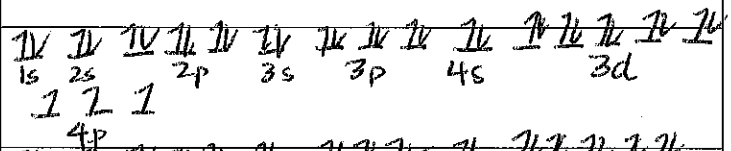
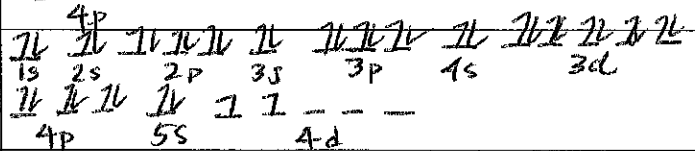
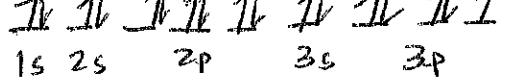
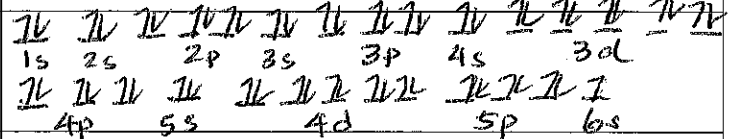
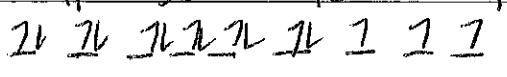
Orbital Diagrams Include the Following Components:

- A box (☐) is drawn for each one of the atoms ground-state orbitals
- An empty box represents an unoccupied orbital
- A box containing one arrow pointing up (↑) represents an orbital containing one unpaired electron
- A box containing two arrows, one pointing up and one pointing down (↑↓), represents a filled orbital with 2 electrons
- Each section of boxes is labeled with the main energy level + sublevel associated with the orbital
  - Sublevels are s, p, d, f

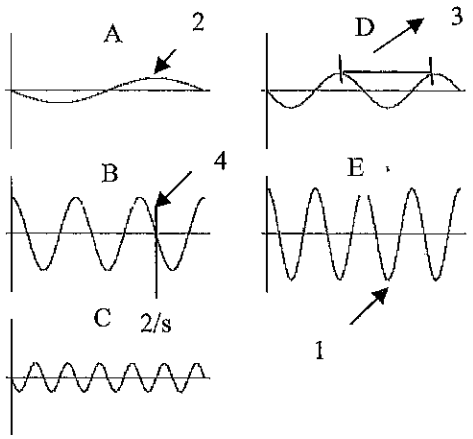
Example: Look at the orbital diagram for Nitrogen



PRACTICE TABLE:

Symbol	# e⁻	Electron Configuration	Noble gas Notation	Orbital Diagram
B	5	$1s^2 2s^2 2p^1$	$[He]2s^2 2p^1$	
Cu	29	$1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^{10}$ (exceptional)	$[Ar]4s^1 3d^{10}$	
Mg	12	$1s^2 2s^2 2p^6 3s^2$	$[Ne]3s^2$	
As	33	$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^3$	$[Ar]4s^2 3d^{10} 4p^3$	
Zr	40	$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^2$	$[Kr]5s^2 4d^2$	
Cl	17	$1s^2 2s^2 2p^6 3s^2 3p^5$	$[Ne]3s^2 3p^5$	
Cs	55	$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6 6s^1$	$[Xe]6s^1$	
P	15	$1s^2 2s^2 2p^6 3s^2 3p^3$	$[Ne]3s^2 3p^3$	

Waves Worksheet



Name the labeled wave characteristics

1. Trough
2. peak or crest
3. wavelength
4. frequency

Which of the waves has.....

The highest frequency? C

The lowest energy? A

The longest wavelength? A

Speed /Frequency / Wavelength

Speed of all Electromagnetic Spectrum Waves (c) = 3.0×10^8 m/s $c=\lambda\nu$

1. Violet light has a wavelength of 4.10×10^{-12} m. What is the frequency?

$c = \lambda\nu$

$\lambda = 4.10 \times 10^{-12}$ m

$\frac{c}{\lambda} = \nu$ $3.0 \times 10^8 \frac{m}{s} \cdot \frac{1}{4.10 \times 10^{-12} m} = 7.3 \times 10^{19}/s$

2. What is the wavelength (in meters) of the electromagnetic carrier wave transmitted by The Sports Fan radio station at a frequency of 640 kHz?(Hint: convert kHz into Hz by multiplying by 10^3.)

$c = \lambda\nu$

$\nu = 640 KHz$

$\frac{c}{\nu} = \lambda$ $3.0 \times 10^8 \frac{m}{s} \cdot \frac{1}{640 KHz} \cdot \frac{1 KHz}{1000/s} = 470$ m

$1000/s = 1000 Hz = 1 KHz$

3. Calculate the wavelength of radiation with a frequency of 8.0×10^{20} Hz. What type of radiation does this represent?

$c = \lambda\nu$

$\nu = 8.0 \times 10^{20}$ Hz or /s

$\frac{c}{\nu} = \lambda$ $3.0 \times 10^8 \frac{m}{s} \cdot \frac{s}{8.0 \times 10^{20}} = 3.8 \times 10^{-13}$ m

Gamma

4. A helium laser emits light with a wavelength of 633 nm. What is the frequency of the light?

$c = \lambda\nu$

$\lambda = 633 nm$

$1 \times 10^9 nm = 1 m$

$\frac{c}{\lambda} = \nu$ $3.0 \times 10^8 \frac{m}{s} \cdot \frac{1}{633 nm} \cdot \frac{1 \times 10^9 nm}{1 m} = 4.7 \times 10^{14}/s$ or Hz

6. An FM radio station broadcasts at a frequency of 107.9 MHz. What is the wavelength of the radio signal?

$c = \lambda\nu$

$\nu = 107.9 MHz$

$1 MHz = 1 \times 10^6 Hz$

$\frac{c}{\nu} = \lambda$ $3.0 \times 10^8 \frac{m}{s} \cdot \frac{1}{107.9 MHz} \cdot \frac{1 MHz}{1 \times 10^6 Hz} =$

2.8 m

Energy / Frequency / Wavelength

E (J) = h x ν	h (Planck's Constant) = 6.626×10^{-34} J · s

9. Calculate the energy of a photon of radiation with a frequency of 8.5×10^{14} Hz.

$E = h\nu$ $\quad \nu = 8.5 \times 10^{14}\ Hz$ $\quad (6.626 \times 10^{-34}\ J \cdot s)(8.5 \times 10^{14}\ /s) = 5.6 \times 10^{-19}\ J$

10. What is the frequency of a wave that has an energy of 1.8×10^{-26} J?

$E = h\nu$ $\quad E = 1.8 \times 10^{-26}\ J$ $\quad \frac{E}{h} = \nu$ $\quad 1.8 \times 10^{-26}\ J \cdot \frac{1}{6.626 \times 10^{-34}\ J \cdot s} = 2.7 \times 10^{7}\ /s$

11. Calculate the energy of a photon of radiation with a wavelength of 6.4×10^{-7} m.

$c = \lambda\nu$ $\quad E = h\nu$

1. either solve for ν using $c = \lambda\nu$ then solve for E using the determined frequency.
2. or . . .

$\frac{c}{\lambda} = \nu$ so $E = \frac{hc}{\lambda}$ $\quad (6.626 \times 10^{-34}\ J \cdot s)\left(\frac{3.0 \times 10^{8}\ m}{s}\right)\left(\frac{1}{6.4 \times 10^{-7}\ m}\right) = 3.1 \times 10^{-19}\ J$

12. What is the energy of light whose wavelength is 4.06×10^{-11} m?

$E = \frac{hc}{\lambda}$ $\quad (6.626 \times 10^{-34}\ J \cdot s)\left(\frac{3.0 \times 10^{8}\ m}{s}\right)\left(\frac{1}{4.06 \times 10^{-11}\ m}\right) = 4.9 \times 10^{-15}\ J$

General Knowledge.

13. Rank these parts of the electromagnetic spectrum from lowest energy (1) to highest (7):

Gamma	Infrared	Microwave	Radio	Visible	Ultraviolet	X-ray
7	3	2	1	4	5	6

14. Rank these parts of the electromagnetic spectrum from lowest frequency (1) to highest (7):

Gamma	Infrared	Microwave	Radio	Visible	Ultraviolet	X-ray
1	5	6	7	4	3	2

15. Rank these parts of the electromagnetic spectrum from shortest wavelength (1) to longest (7):

Gamma	Infrared	Microwave	Radio	Visible	Ultraviolet	X-ray
7	3	2	1	4	5	6

16. What is the relationship between frequency and wavelength? (Direct or (Inverse))

17. What is the relationship between frequency and energy? ((Direct) or Inverse)